

PENNIUM-123

Purpose:

Radioactive materials become less radioactive over time as a result of a process known as radioactive decay. An understanding of radioactive decay is essential to an understanding of the plans for permanent disposal of radioactive waste.

This activity is one in a series designed to convey factual information relevant to radioactivity, radioactive materials, and radiation in a manner students will find appealing and fun, as well as educational.

Concepts:

1. Radioactive materials become less radioactive over time through the process of radioactive decay.
2. Radioactive decay curves may be illustrated by graphing the flipping of a coin.

Duration of Lesson:

One 50-minute class period

Objectives:

As a result of participation in this activity, the learner will be able to:

1. collect data;
2. arrange the data on a chart; and
3. graph the collected and charted data.

Skills:

Collecting and organizing data, deductive reasoning, drawing conclusions, filling in a chart, plotting data on a graph, reading a graph

Vocabulary:

Half-life, isotope, radioactive decay

Materials:

Activity Sheet

Pennium-123, p. 105

Other

1 penny for each participant

1 box (if alternate experiment is conducted)

Suggested Procedure:

1. Complete as described on handout.
2. This activity may be adapted for a shorter demonstration, or for students to do on an individual basis as follows:

Put pennies in a box, shake them, and count “heads” and “tails.” Remove “heads.” Record the numbers that were “heads” on the chart. Repeat until the box is empty. Complete the chart and graph as described on handout.

Note: To be sure of getting accurate results, ask who got “heads” and who got “tails” before announcing who is “out.” This is sometimes necessary because students like to continue playing.

Sample Discussion Questions:

1. What shape line did you get?
(A steep curve with a flat bottom.)
2. Why does this curve have this shape?
(There are a large number of people that begin the activity, and as each half-life passes there are fewer and fewer to take half from. The total number of participants is decreasing at a decreasing rate.)
3. After five turns how many students are out?
(Answers will vary depending on the number of participants.)
4. Why isn't the above number half of the total?
(It was one-half after the first turn.)
5. Will the number of students out always be one-half the number of students who flipped?
(No, this is an average, just as radioactive decay is random, so is flipping a coin.)
6. Can we predict which students will be out each flip?
(No.)
7. Compare this activity to radioactive decay.
(Radioactive decay is a random process. We cannot predict which atom will decay or when a particular atom will decay. We also cannot expect exactly half of the total number of isotopes to decay during every half-life.)

Teacher Evaluation of Learner Performance:

Collect and grade student activity sheets to verify comprehension.

Enrichment:

Radioactive Decay Series, pp. SR-31, 139

Chart of Some Important Transitions in Spent Fuel, p. 149

Hazards of Some Isotopes in Spent Fuel Compared to the Hazard of Uranium Ore, p. 153